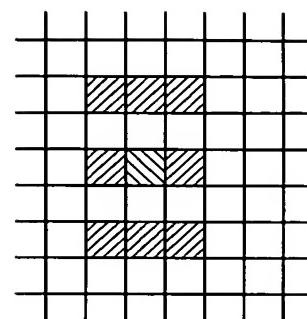


-PRIOR ART-

*FIG. 1A*



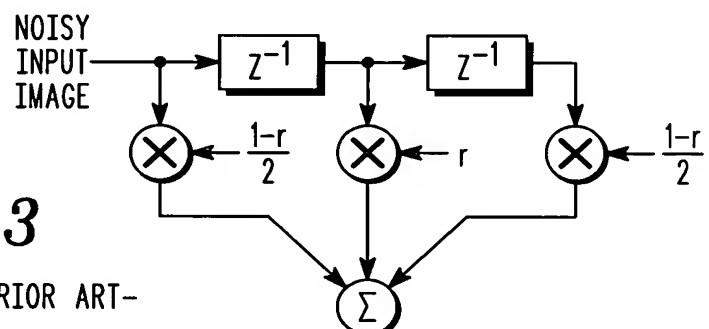
-PRIOR ART-

*FIG. 1B*



-PRIOR ART-

*FIG. 2*



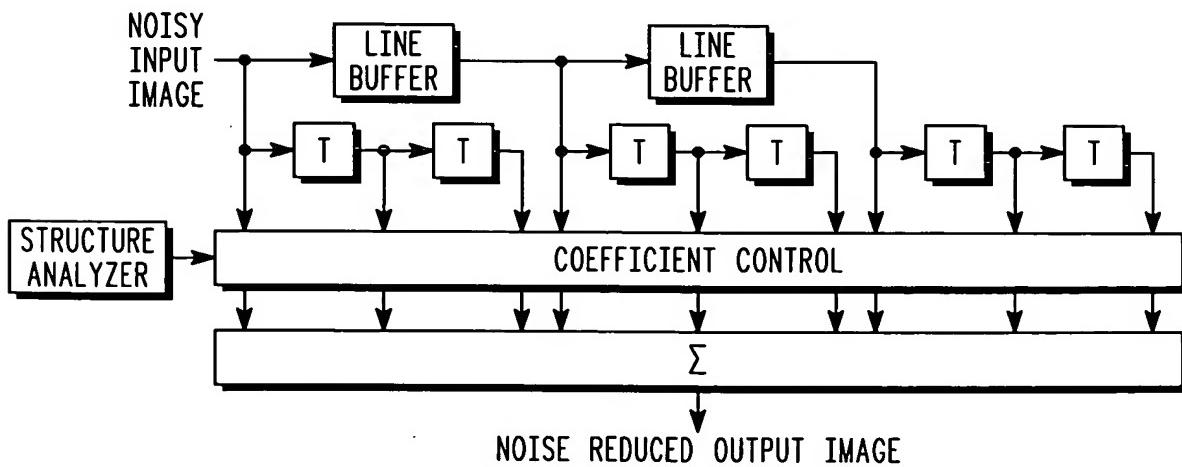
*FIG. 3*

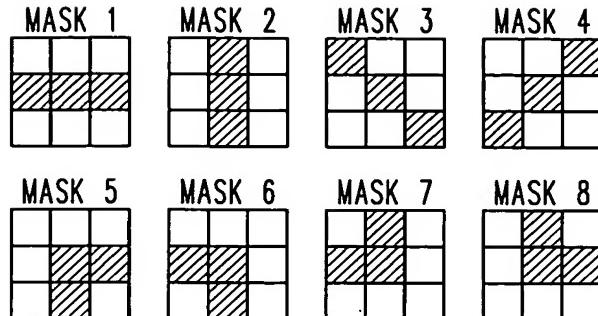
-PRIOR ART-

NOISE REDUCED OUTPUT IMAGE

*FIG. 4*

-PRIOR ART-





-PRIOR ART-

**FIG. 5**

$k=0$	$k=1$	$k=2$	$k=3$
DIAGONAL, LEFT	VERTICAL	DIAGONAL, RIGHT	HORIZONTAL
$\begin{array}{ c c c } \hline & & -1/4 \\ \hline & 1/2 & \\ \hline -1/4 & & \\ \hline \end{array}$	$\begin{array}{ c c c } \hline & -1/4 & \\ \hline 1/2 & & \\ \hline -1/4 & & \\ \hline \end{array}$	$\begin{array}{ c c c } \hline -1/4 & & \\ \hline & 1/2 & \\ \hline & & -1/4 \\ \hline \end{array}$	$\begin{array}{ c c c } \hline & & \\ \hline -1/4 & 1/2 & -1/4 \\ \hline & & \\ \hline \end{array}$
CORNER, UP-RIGHT	CORNER, UP-LEFT	CORNER, LOW-LEFT	CORNER, LOW-RIGHT
$\begin{array}{ c c c } \hline & -1/4 & \\ \hline & 1/2 & -1/4 \\ \hline & & \\ \hline \end{array}$	$\begin{array}{ c c c } \hline & -1/4 & \\ \hline -1/4 & 1/2 & \\ \hline & & \\ \hline \end{array}$	$\begin{array}{ c c c } \hline & & \\ \hline -1/4 & 1/2 & \\ \hline & -1/4 & \\ \hline \end{array}$	$\begin{array}{ c c c } \hline & & \\ \hline & 1/2 & -1/4 \\ \hline & -1/4 & \\ \hline \end{array}$

**FIG. 6**

$k=[0,3]$	$k=[0,7]$		
MINIMUM DIRECTION	% (4HP)	% (8HP)	MINIMUM DIRECTION
DIAGONAL LEFT ( $k=0$ )	48	20	21
VERTICAL ( $k=1$ )	65	26	18
DIAGONAL RIGHT ( $k=2$ )	12	14	21
HORIZONTAL ( $k=3$ )	14	21	19
TOTAL (4HP)	139		160
			TOTAL (8HP)

**FIG. 7**

□

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D=[1,4]	<table border="1"><tr><td></td><td></td><td>1</td></tr><tr><td></td><td>2</td><td></td></tr><tr><td>1</td><td></td><td></td></tr></table>			1		2		1			<table border="1"><tr><td>1</td><td>1</td><td></td></tr><tr><td></td><td>4</td><td></td></tr><tr><td></td><td></td><td>1</td></tr><tr><td></td><td>1</td><td>1</td></tr></table>	1	1			4				1		1	1	<table border="1"><tr><td></td><td>1</td><td>1</td></tr><tr><td>1</td><td>6</td><td>1</td></tr><tr><td></td><td>1</td><td>1</td></tr></table>		1	1	1	6	1		1	1	<table border="1"><tr><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>8</td><td>1</td></tr><tr><td></td><td>1</td><td>1</td></tr><tr><td></td><td>1</td><td>1</td></tr></table>	1	1	1	1	8	1		1	1		1	1
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FIG. 8A

D=[5,8]	<table border="1"><tr><td>1</td><td>2</td><td></td></tr><tr><td>2</td><td>10</td><td>2</td></tr><tr><td></td><td>2</td><td>1</td></tr></table>	1	2		2	10	2		2	1	<table border="1"><tr><td>1</td><td>1</td><td>1</td></tr><tr><td>2</td><td>12</td><td>2</td></tr><tr><td>1</td><td>2</td><td>1</td></tr></table>	1	1	1	2	12	2	1	2	1	<table border="1"><tr><td></td><td>3</td><td>1</td></tr><tr><td>3</td><td>14</td><td>3</td></tr><tr><td>1</td><td>3</td><td></td></tr></table>		3	1	3	14	3	1	3		<table border="1"><tr><td>1</td><td>3</td><td>1</td></tr><tr><td>3</td><td>16</td><td>3</td></tr><tr><td>1</td><td>3</td><td>1</td></tr></table>	1	3	1	3	16	3	1	3	1
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FIG. 8B

D=1	<table border="1"><tr><td>1/4</td><td></td><td></td></tr><tr><td></td><td>1/2</td><td></td></tr><tr><td></td><td></td><td>1/4</td></tr></table>	1/4				1/2				1/4	<table border="1"><tr><td></td><td>1/4</td><td></td></tr><tr><td></td><td>1/2</td><td></td></tr><tr><td></td><td></td><td>1/4</td></tr></table>		1/4			1/2				1/4	<table border="1"><tr><td></td><td></td><td>1/4</td></tr><tr><td></td><td>1/2</td><td></td></tr><tr><td>1/4</td><td></td><td></td></tr></table>			1/4		1/2		1/4			<table border="1"><tr><td></td><td></td><td></td></tr><tr><td>1/4</td><td>1/2</td><td>1/4</td></tr><tr><td></td><td></td><td></td></tr></table>				1/4	1/2	1/4			
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D=4	<table border="1"><tr><td>1/16</td><td>1/16</td><td>1/16</td></tr><tr><td>1/16</td><td>1/2</td><td>1/16</td></tr><tr><td>1/16</td><td>1/16</td><td>1/16</td></tr></table>	1/16	1/16	1/16	1/16	1/2	1/16	1/16	1/16	1/16	<table border="1"><tr><td>1/16</td><td></td><td></td></tr><tr><td>1/16</td><td>1/2</td><td></td></tr><tr><td>1/16</td><td></td><td></td></tr></table>	1/16			1/16	1/2		1/16			<table border="1"><tr><td></td><td></td><td></td></tr><tr><td></td><td>1/12</td><td></td></tr><tr><td></td><td></td><td></td></tr></table>					1/12					<table border="1"><tr><td></td><td></td><td></td></tr><tr><td></td><td>1/16</td><td></td></tr><tr><td></td><td></td><td></td></tr></table>					1/16				
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FIG. 9

D	COEFFICIENT VALUES FOR NUMBER OF EQUAL DIRECTIONS										N
	1/2	1/4			3/20		1/10				
1	1/2	1/4			3/20		1/10				8
2	1/2	1/4				1/8					28
3	1/2	1/4		1/6				1/12			56
4	1/2		3/16		1/8				1/16		70
5	1/2			3/20		1/10				1/20	56
6	1/2				1/8			1/12			28
7	1/2					3/28		1/14			8
8	1/2						3/32				1/32
										1	

FIG. 10

]

D=1				$\sqrt{1110}$	$\sqrt{1111}$	$\sqrt{1112}$	$\sqrt{1113}$	$\sqrt{1114}$	$\sqrt{1115}$	$\sqrt{1116}$	$\sqrt{1117}$
$1/4$	$1/2$	$1/4$	$1/4$								

D=2				$\sqrt{1120}$	$\sqrt{1121}$	$\sqrt{1122}$	$\sqrt{1123}$	$\sqrt{1124}$	$\sqrt{1125}$
$1/8$	$1/8$	$1/8$	$1/8$						

D=3				$\sqrt{1130}$	$\sqrt{1131}$	$\sqrt{1132}$	$\sqrt{1133}$	$\sqrt{1134}$	$\sqrt{1135}$	$\sqrt{1136}$	$\sqrt{1137}$
$1/12$	$1/12$	$1/12$	$1/12$								

D=4				$\sqrt{1140}$	$\sqrt{1141}$	$\sqrt{1142}$	$\sqrt{1143}$	$\sqrt{1144}$	$\sqrt{1145}$	$\sqrt{1146}$	
$1/16$	$1/16$	$1/16$	$1/16$								

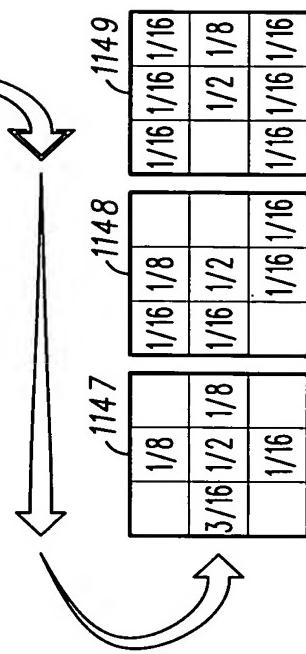


FIG. 11A

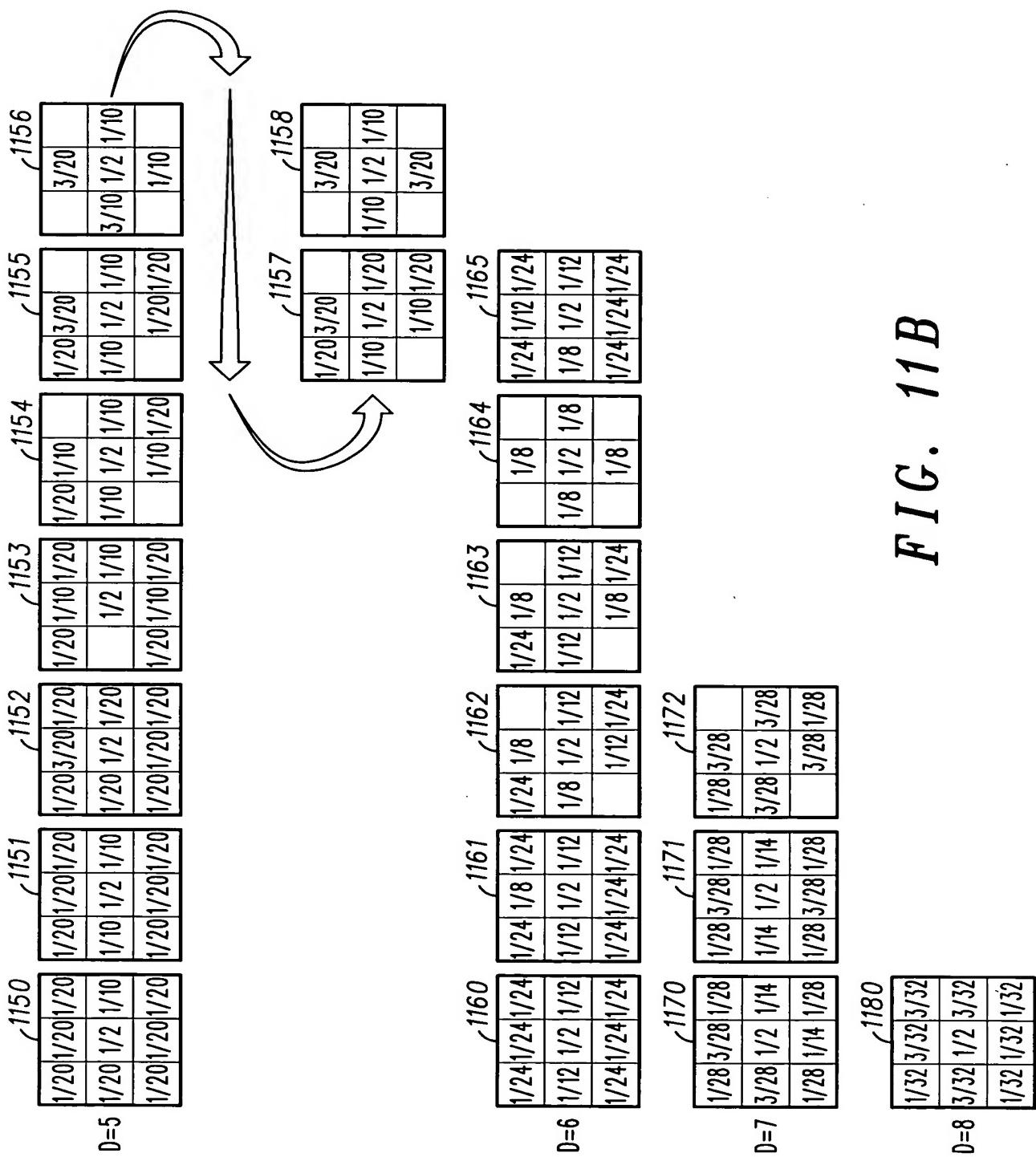
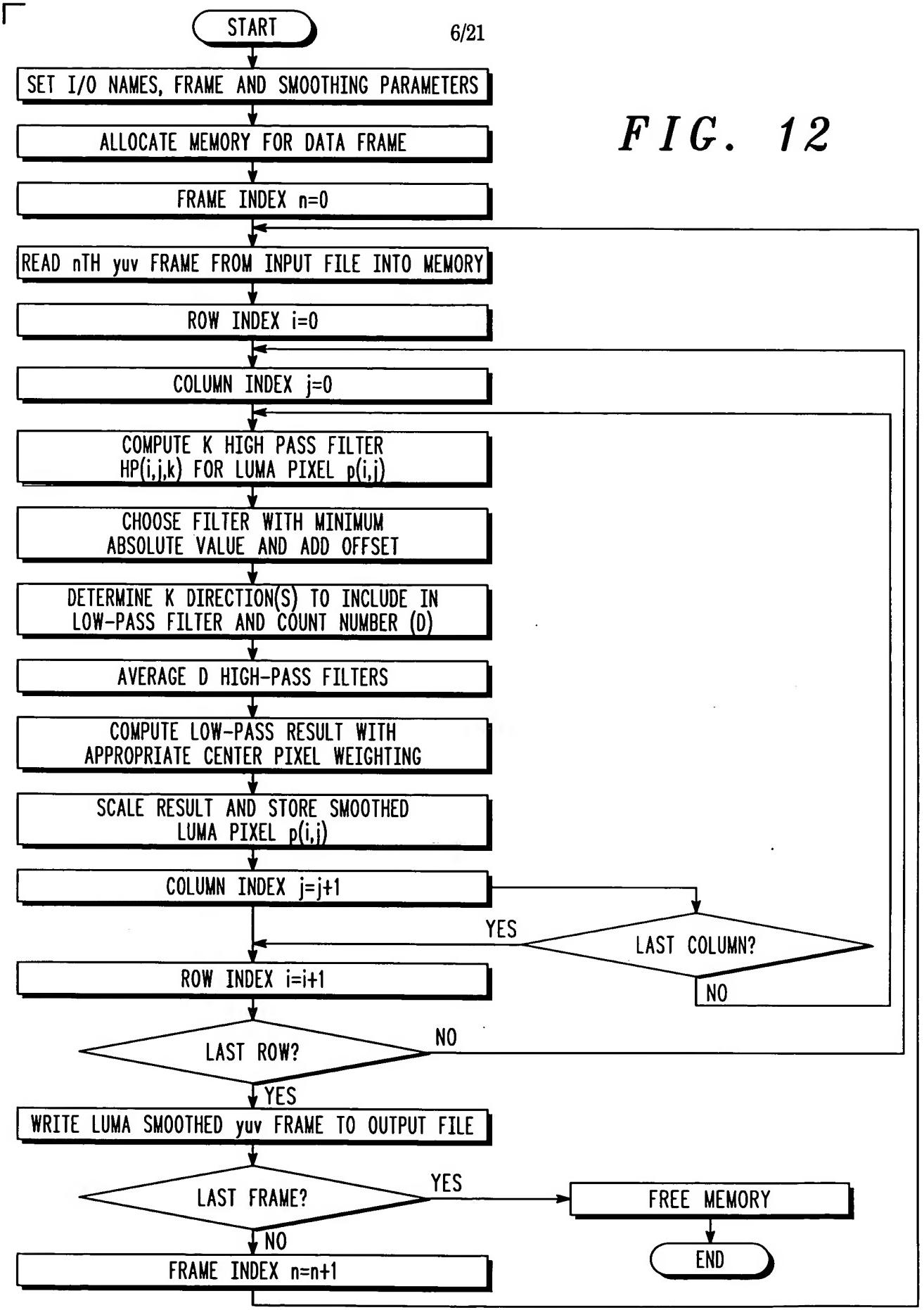


FIG. 11B



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D=1	D=2	D=3	D=4
0 -1 0	0 -1 0	-1 -1 0	-1 -1 -1
0 2 0	-1 -4 -1	-1 6 -1	-1 8 -1
0 -1 0	0 -1 0	0 -1 -1	-1 -1 -1
0 60 0	0 30 0	20 20 0	15 15 15
0 138 0	0 136 0	20 136 20	15 136 15
0 60 0	0 30 0	0 20 20	15 15 15

FIG. 13

VERTICAL	DIAGONAL LEFT	DIAGONAL RIGHT	HORIZONTAL																																				
<table border="1"> <tr><td></td><td>-1/4</td><td></td></tr> <tr><td></td><td>1/2</td><td></td></tr> <tr><td></td><td>-1/4</td><td></td></tr> </table>		-1/4			1/2			-1/4		<table border="1"> <tr><td></td><td></td><td>-1/4</td></tr> <tr><td></td><td></td><td>1/2</td></tr> <tr><td>-1/4</td><td></td><td></td></tr> </table>			-1/4			1/2	-1/4			<table border="1"> <tr><td>-1/4</td><td></td><td></td></tr> <tr><td></td><td>1/2</td><td></td></tr> <tr><td></td><td></td><td>-1/4</td></tr> </table>	-1/4				1/2				-1/4	<table border="1"> <tr><td></td><td></td><td></td></tr> <tr><td>-1/4</td><td>1/2</td><td>-1/4</td></tr> <tr><td></td><td></td><td></td></tr> </table>				-1/4	1/2	-1/4			
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FIG. 14

M1 [ H G F E D C B A ] UP (ROW i-1)

M2 [ Q P O N M L K J ] MID (ROW i)

M3 [ Z Y X W V U T S ] DWN (ROW i+1)

FIG. 15

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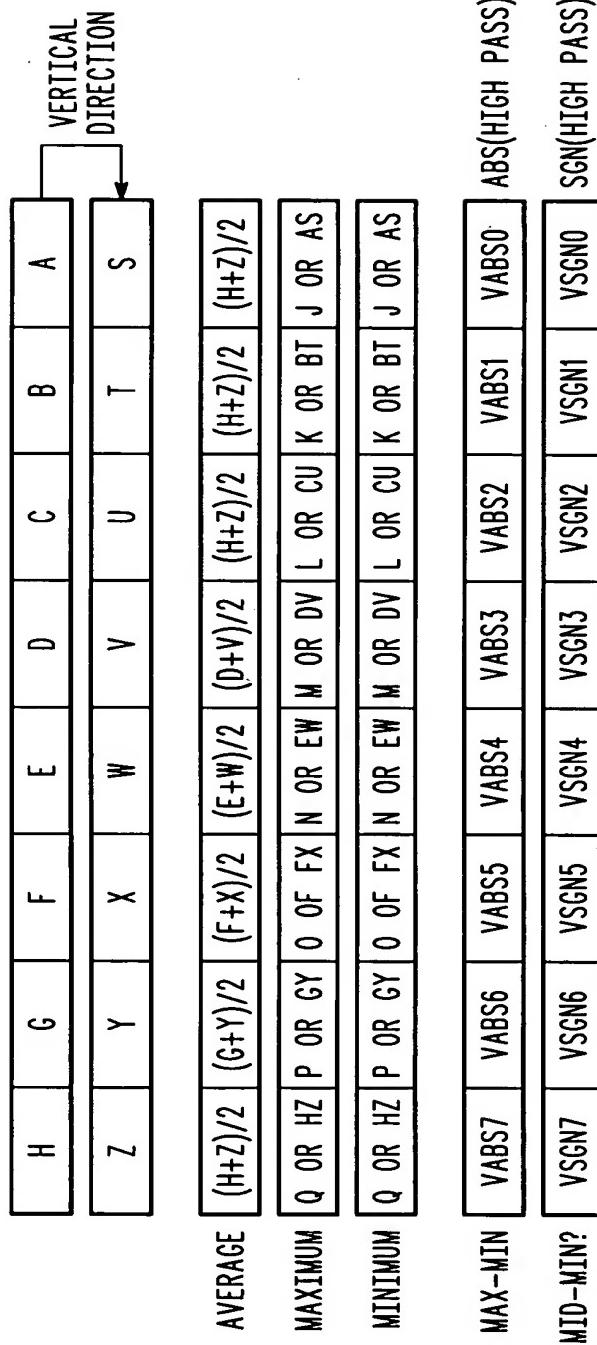
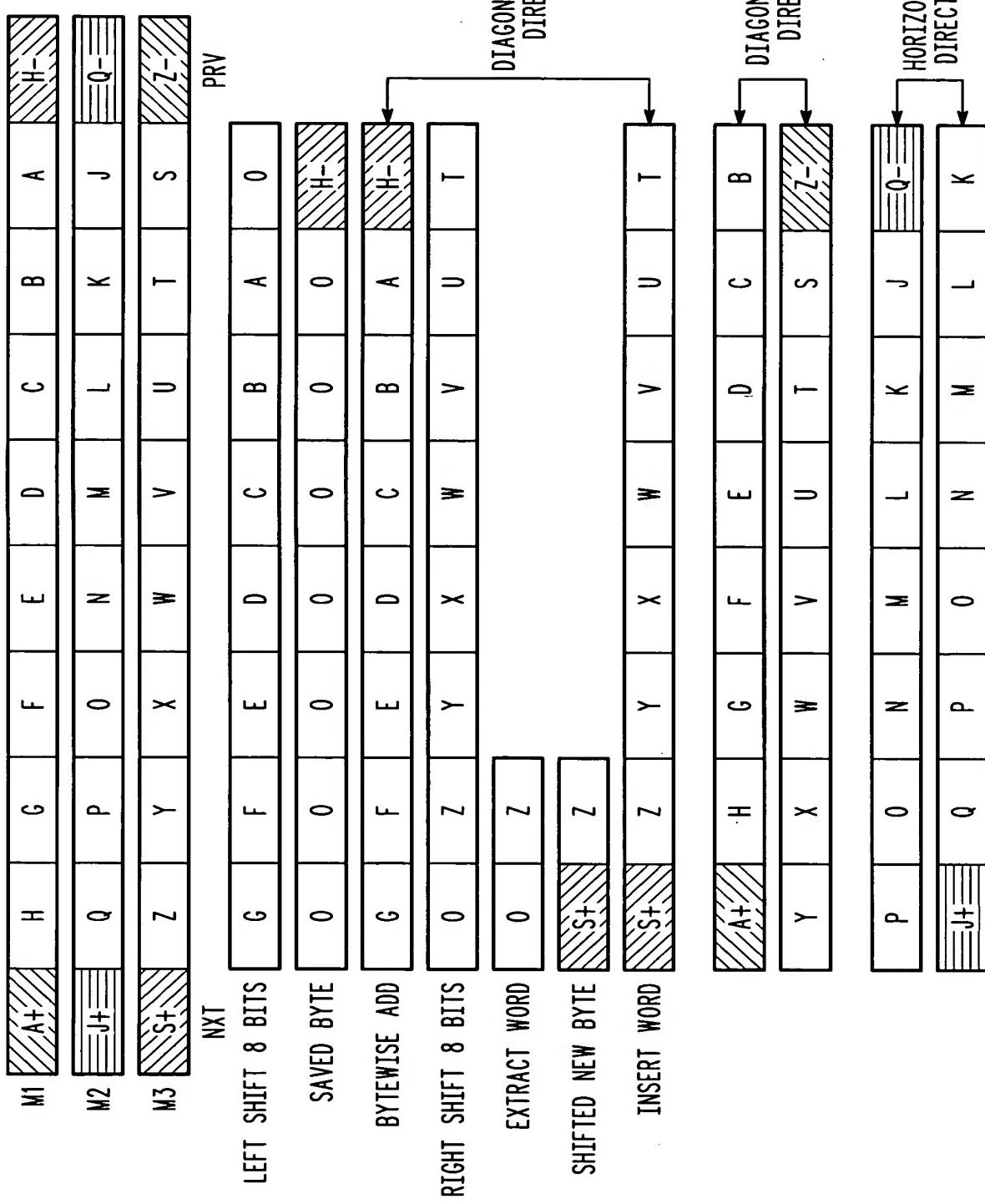


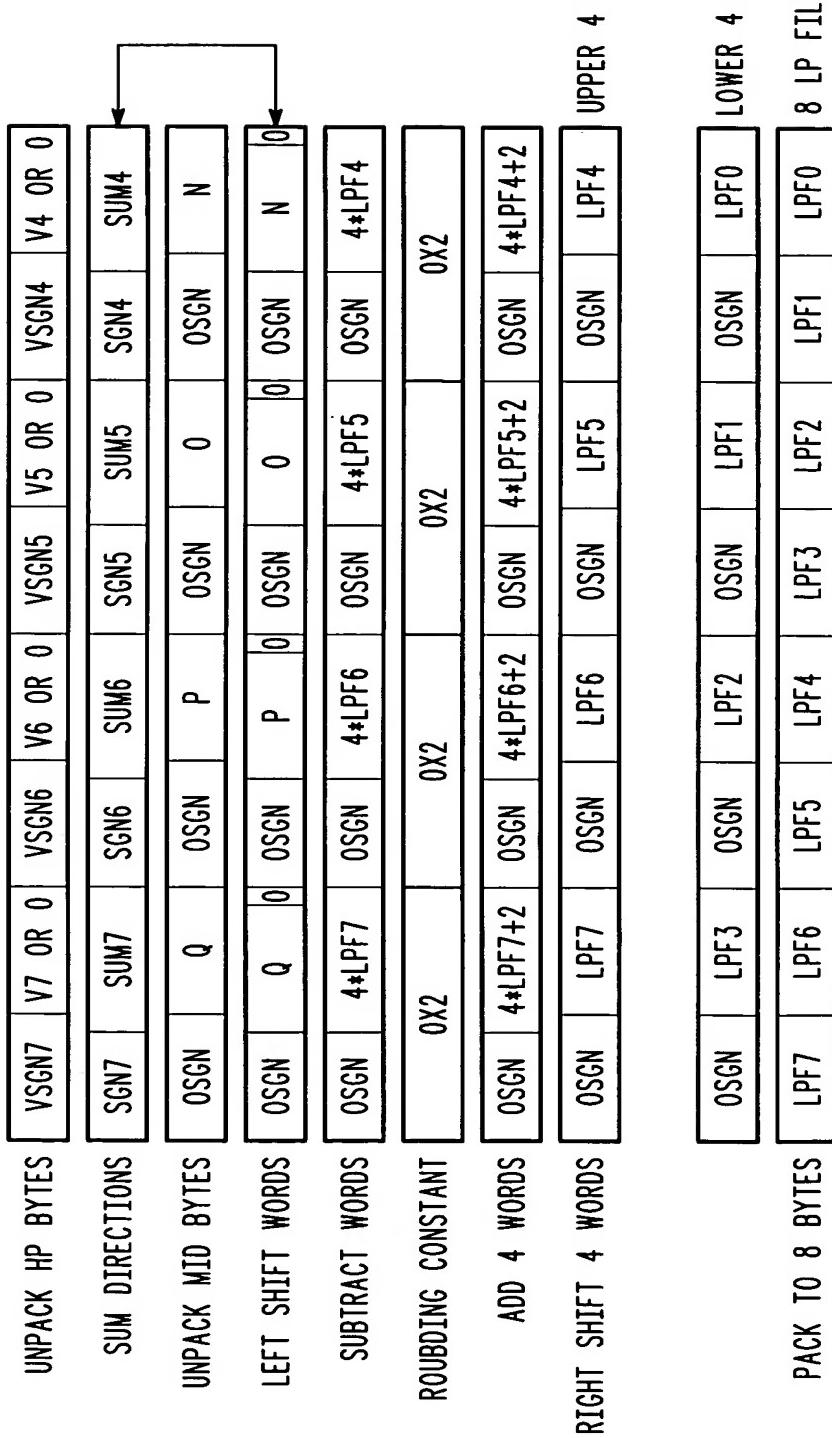
FIG. 16

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**FIG. 17**



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*FIG. 18*

D=1	D=2	D=3	D=4
HIGH-PASS			
0 -1/2 0	0 -1/2 0	-1/2 -1/2 0	-1/2 -1/2 -1/2
0 1 0	-1/2 2 -1/2	-1/2 3 -1/2	-1/2 4 -1/2
0 -1/2 0	0 -1/2 0	0 -1/2 -1/2	-1/2 -1/2 -1/2
LOW-PASS (75%)			
0 1/8 0	0 1/8 0	1/8 1/8 0	1/8 1/8 1/8
0 3/4 0	1/8 1/2 1/8	1/8 1/4 1/8	1/8 0 1/8
0 1/8 0	0 1/8 0	0 1/8 1/8	1/8 1/8 1/8

FIG. 19

EVEN  
LUMINANCE ROWS

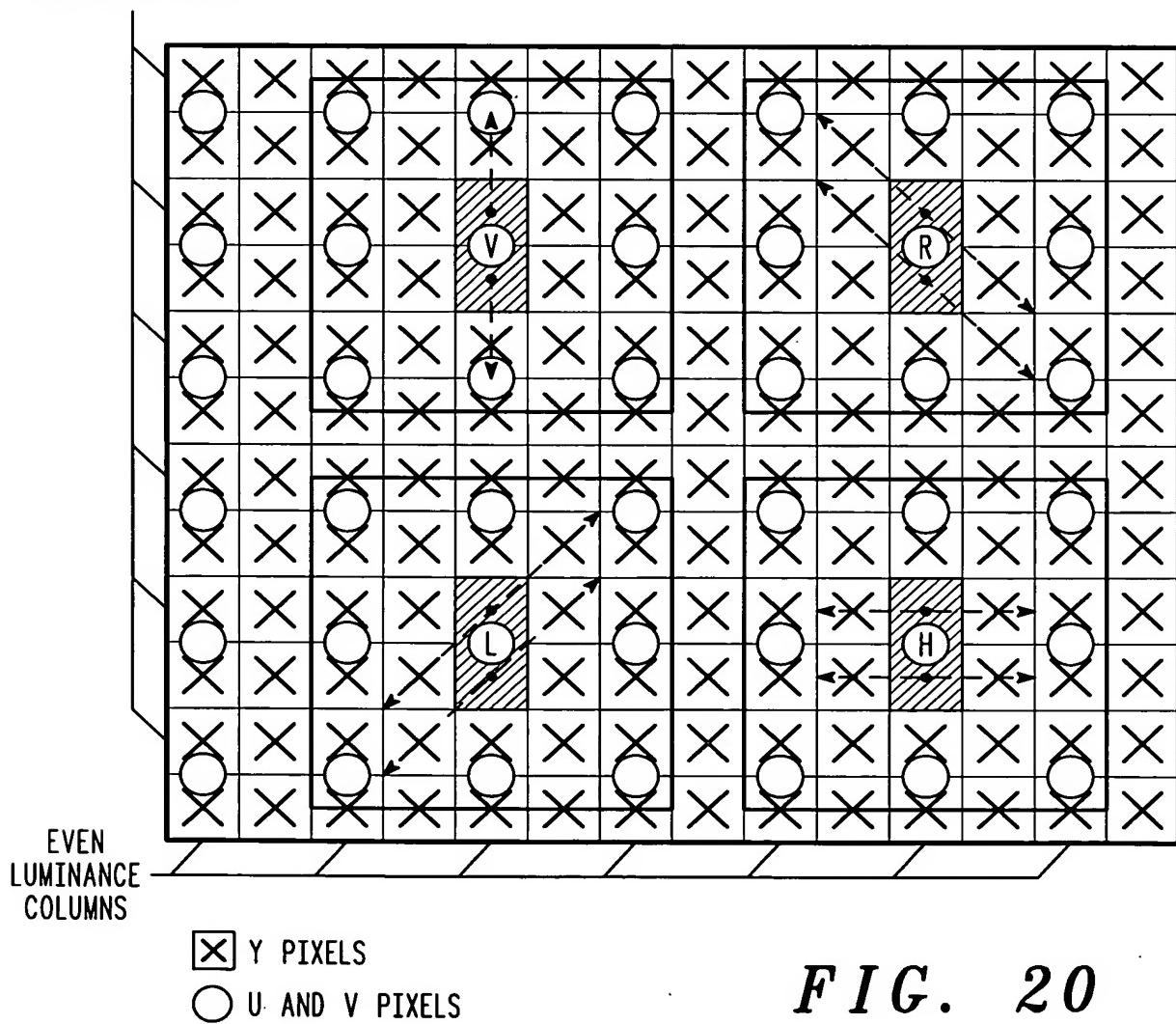
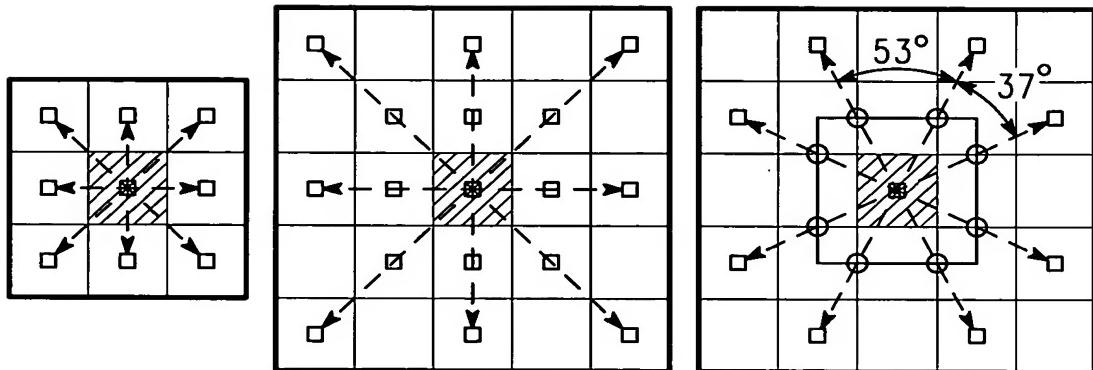
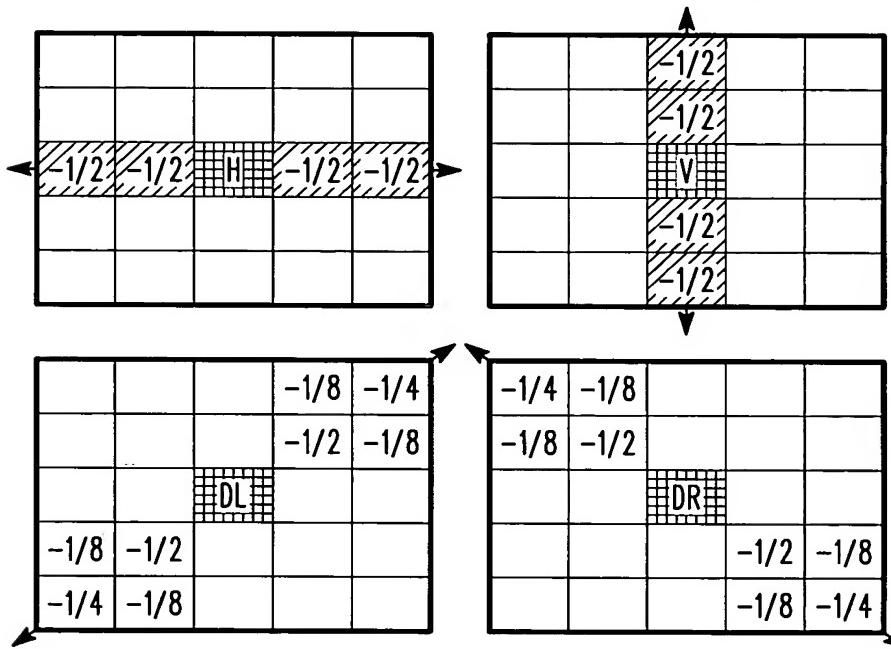


FIG. 20

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*FIG. 21*



*FIG. 22*

DL	DL	V	DR	DR
DL	DL	V	DR	DR
H	H	MID	H	H
DR	DR	V	DL	DL
DR	DR	V	DL	DL

-1/4	-1/8	-1/2	-1/8	-1/4
-1/8	-1/2	-1/2	-1/2	-1/8
-1/2	-1/2	MID	-1/2	-1/2
-1/8	-1/2	-1/2	-1/2	-1/8
-1/4	-1/8	-1/2	-1/8	-1/4

*FIG. 23*

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INDEX	NAME	ANGEL (DEGREES)	$\Delta x_1, \Delta y_1$	$\Delta x_2, \Delta y_2$
1	HORIZONTAL (H)	0, 180	$\pm 1, 0$	$\pm 2, 0$
2	DIAGONAL LEFT (DL)	45, -135	$\pm 1, \pm 1$	$\pm 2, \pm 2$
3	VERTICAL (V)	$\pm 90$	$0, \pm 1$	$0, \pm 2$
4	DIAGONAL RIGHT (DR)	135, -45	$\mp 1, \mp 1$	$\mp 2, \mp 2$
5	LESSER ANGLE LEFT (LL)	$\sim (+27), \sim (-153)$	$\pm 1, \pm 1/2$	$\pm 2, \pm 1$
6	LESSER ANGLE RIGHT (LR)	$\sim (-27), \sim (+153)$	$\mp 1, \mp 1/2$	$\mp 2, \mp 1$
7	GREATER ANGLE LEFT (GL)	$\sim (+63), \sim (-117)$	$\pm 1/2, \pm 1$	$\pm 1, \pm 2$
8	GREATER ANGLE RIGHT (GR)	$\sim (+117), \sim (-63)$	$\mp 1/2, \mp 1$	$\mp 1, \mp 2$

FIG. 24

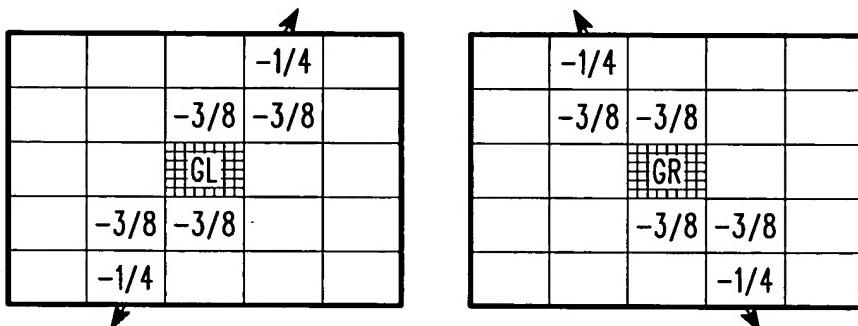
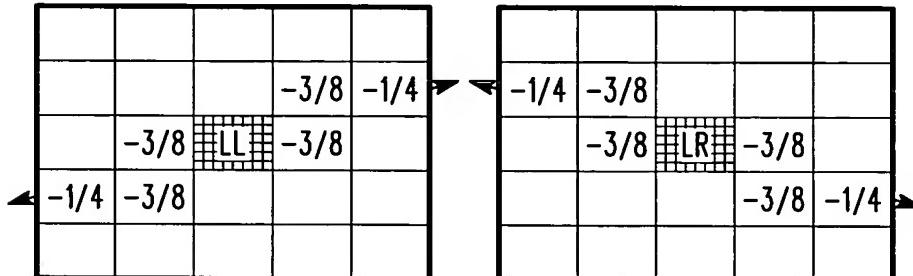
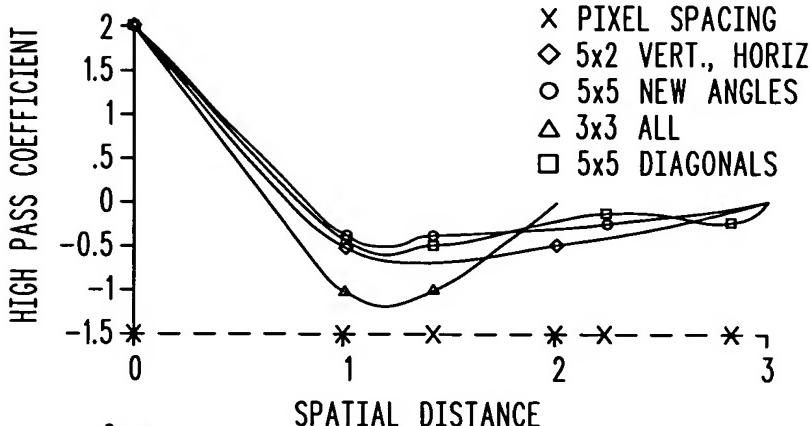


FIG. 25

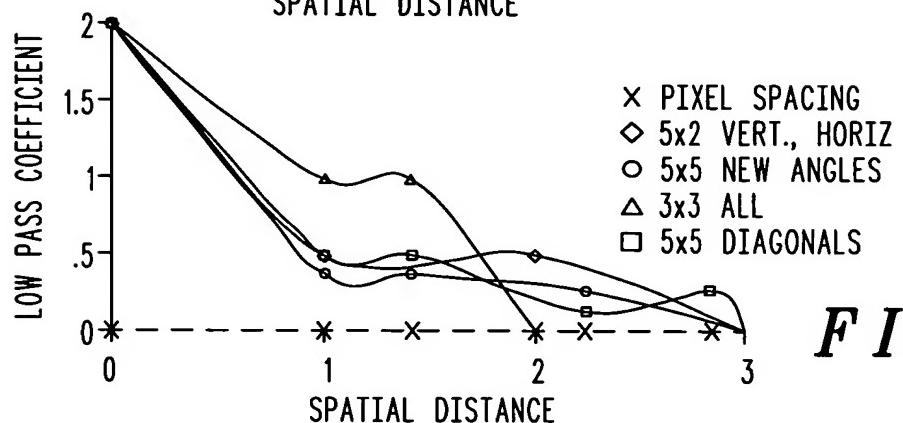
DL	DL GL	V	DR GR	DR	-1/4	-3/8	-1/2	-3/8	-1/4
DL LL	DL LL,GL	V GL,GR	DR LR,GR	DR LR	-3/8	-1 1/4	-1 1/4	-1 1/4	-3/8
H	H LL,LR	MID	H LL,LR	H	-1/2	-1 1/4	MID	-1 1/4	-1/2
DR LR	DR LR,GR	V GL,GR	DL LL,GL	DL LL	-3/8	-1 1/4	-1 1/4	-1 1/4	-3/8
DR	DR GR	V	DL GL	DL	-1/4	-3/8	-1/2	-3/8	-1/4

FIG. 26

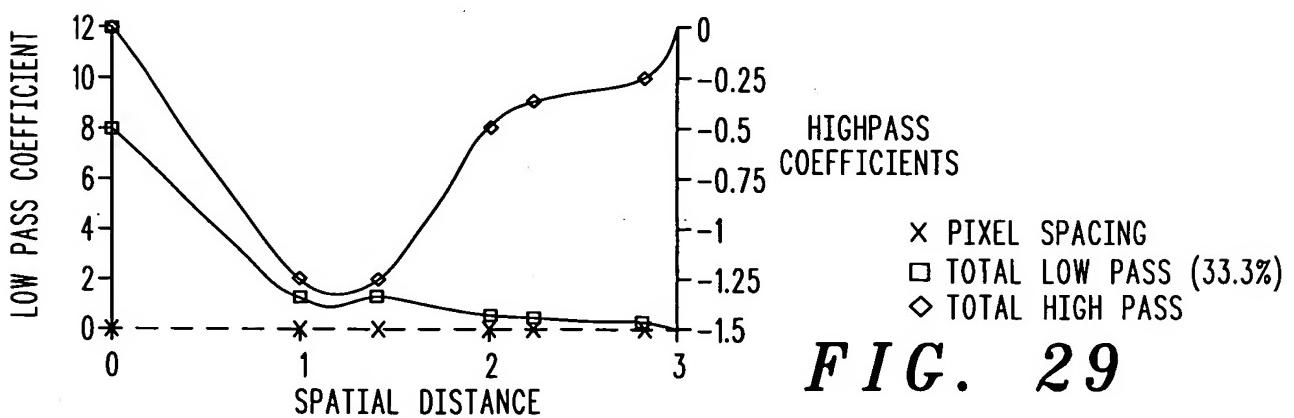
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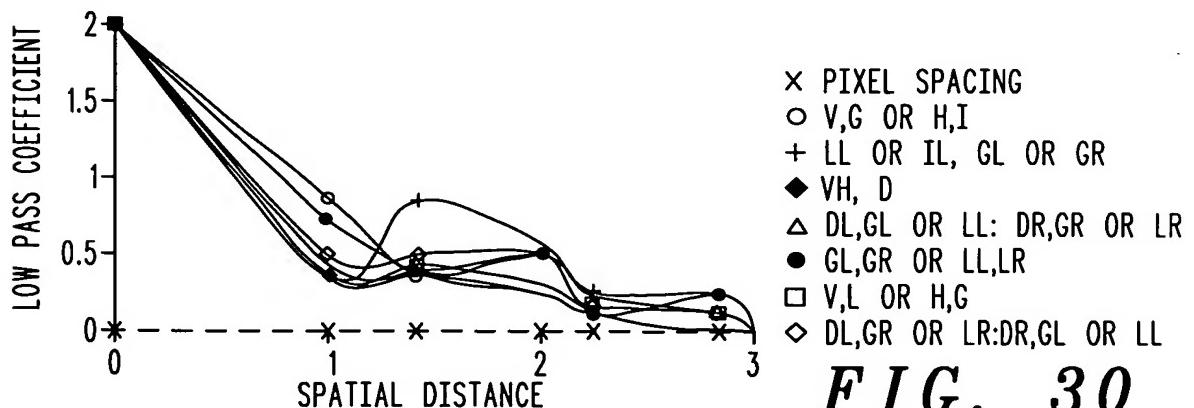
**FIG. 37**



**FIG. 28**



**FIG. 29**



**FIG. 30**

C1	C0	B3	B2	B1	B0	A3	A2
C1	C0	B3	B2	B1	B0	A3	A2
C1	C0	B3	B2	B1	B0	A3	A2
C1	C0	B3	B2	B1	B0	A3	A2
C1	C0	B3	B2	B1	B0	A3	A2

FIG. 31

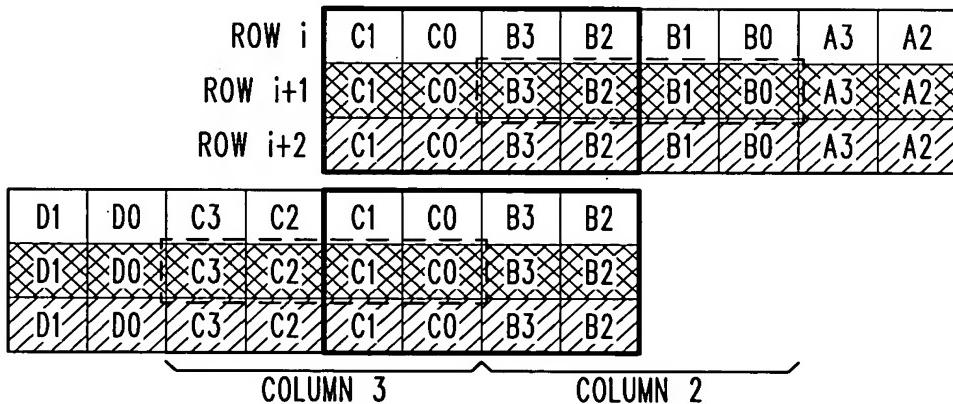


FIG. 32

M1

DON'T CARE				B1	B0	A3	A2
DON'T CARE	B3	B2	B1	B0	A3	A2	
C1	C0	B3	B2	B1	B0	A3	A2

M1=\_M\_PINSRW(M1, P1(i,j).W[1],2)  
M1=\_M\_PINSRW(M1, P1(i,j+1).W[0],3)

M2

DON'T CARE				B1	B0	A3	A2
DON'T CARE	B3	B2	B1	B0	A3	A2	
C1	C0	B3	B2	B1	B0	A3	A2

M2=\_M\_PINSRW(M2, P2(i+1,j).W[1],2)

M3

DON'T CARE				B1	B0	A3	A2
DON'T CARE	B3	B2	B1	B0	A3	A2	
C1	C0	B3	B2	B1	B0	A3	A2

M3=\_M\_PINSRW(M3, P3(i+2,j).W[1],2)

FIG. 33

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M1	C1	C0	B3	B2	C1	C0	B3	B2
M2=_M_PSRLGI(M2, 32)	ZERO	ZERO	ZERO	ZERO	C1	C0	B3	B2
M3=_M_PSRLGI(M1, 32)	ZERO	ZERO	ZERO	ZERO	C1	C0	B3	B2

FIG. 34

M0=_M_PSRLQI(M1, 16)	ZERO	ZERO	C1	C0	B3	B2	B1	B0
M4=_M_PSRLQI(M2, 8)	ZERO	C1	C0	B3	B2	B1	B0	A3
M4=_M_PUNPCKLDQ(M4, M0)	B3	B2	B1	B0	B2	B1	B0	A3
M0=_M_PSRLQI(M3, 16)	ZERO	ZERO	C1	C0	B3	B2	B1	B0
M5=_M_PSRLQI(M2, 24)	ZERO	ZERO	ZERO	C1	C0	B3	B2	B1
M5=_M_PUNPCKLDQ(M5, M0)	B3	B2	B1	B0	C0	B3	B2	B1
M4=_M_PAVGB(M4, M5)	AV3	AV2	AV1	AV1	AH3	AH2	AH1	AH0
	VERTICAL AVERAGE				HORIZONTAL AVERAGE			

FIG. 35

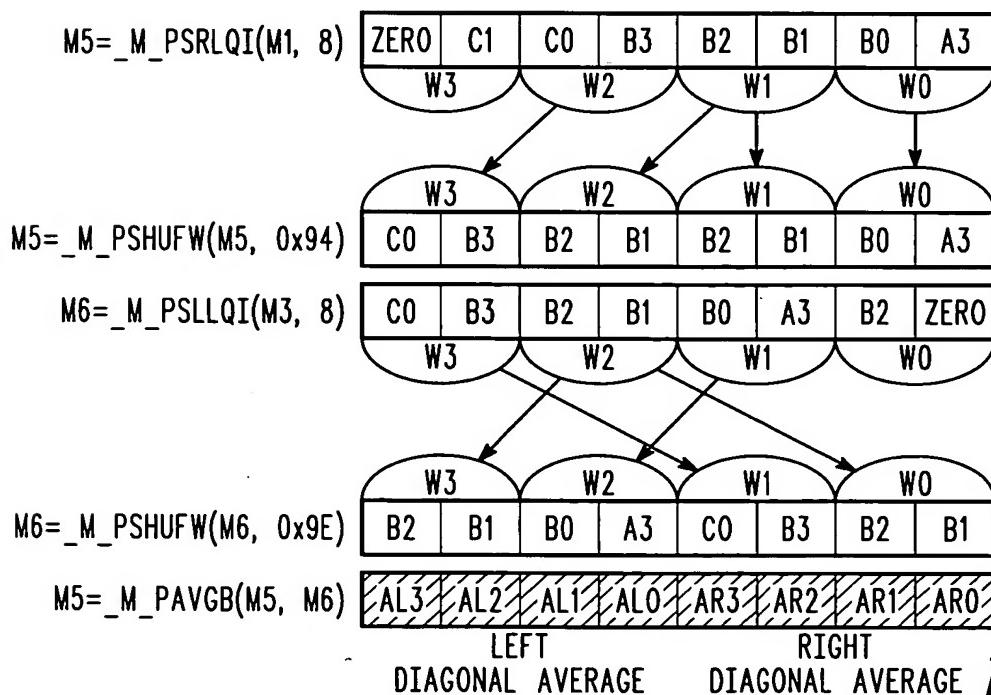
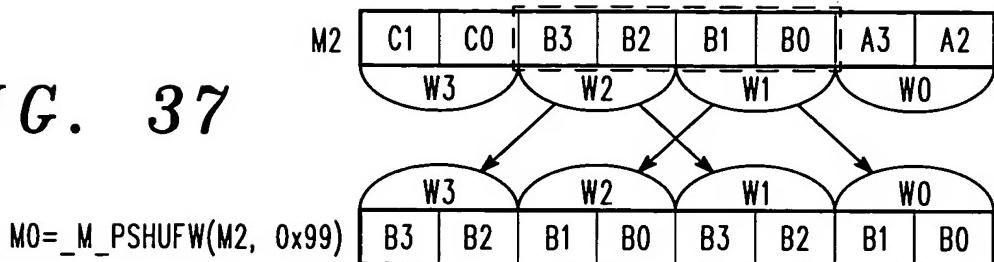


FIG. 36

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*FIG. 37*



*FIG. 38*

M6=_M_PMINUB(M0, M4)	NV3	NV2	NV1	NV0	NH3	NH2	NH1	NH0
M4=_M_PMAXUB(M0, M4)	XV3	XV2	XV1	XV0	XH3	XH2	XH1	XH0
M4=_M_PSUBUSB(M4, M6)	V3	V2	V1	V0	H3	H2	H1	H0
	ABS VERTICAL HP				ABS HORIZONTAL HP			

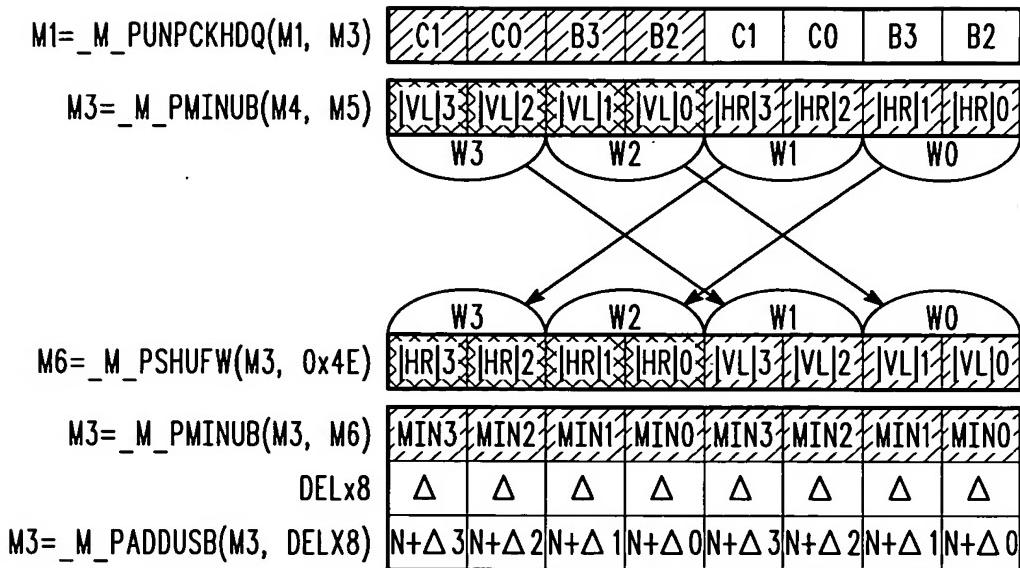
SGNVH=_M_PCMPEQB(M0, M6)	SV3	SV2	SV1	SV0	SH3	SH2	SH1	SH0
	VERTICAL HP SIGNS				HORIZONTAL HP SIGNS			

M7=_M_PMINUB(M0, M5)	NL3	NL2	NL1	NL0	NR3	NR2	NR1	NR0
M5=_M_PMAXUB(M0, M5)	XL3	XL2	XL1	XL0	XR3	XR2	XR1	XR0
M5=_M_PSUBUSB(M5, M7)	L3	L2	L1	L0	R3	R2	R1	R0
	ABS LEFT DIAGONAL HP				ABS RIGHT DIAGONAL HP			

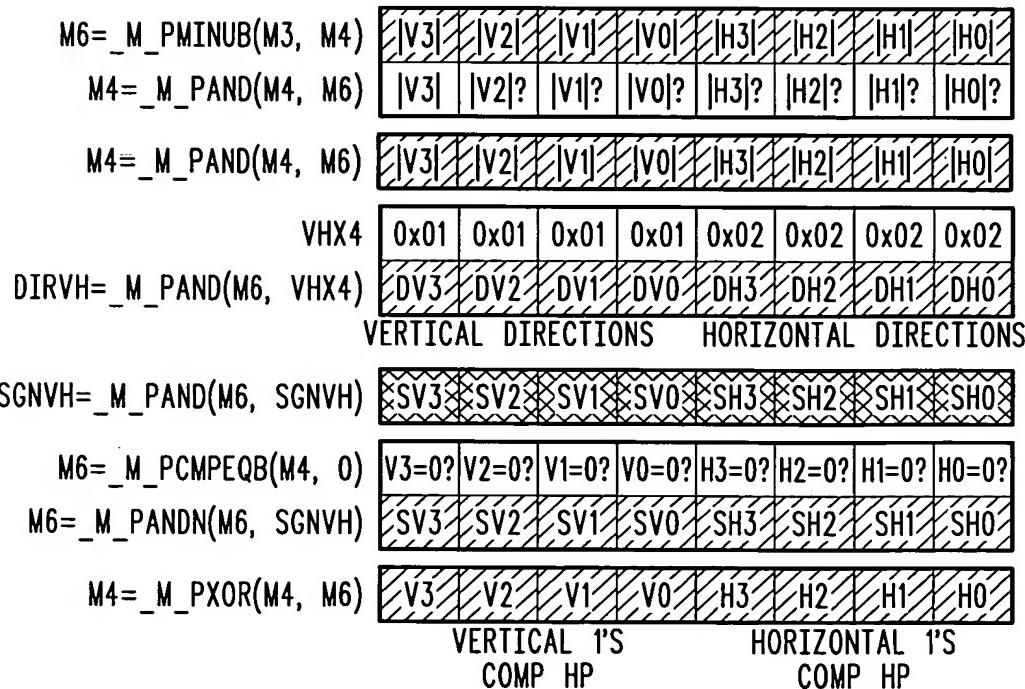
  

SGNLR=_M_PCMPEQB(M0, M7)	SL3	SL2	SL1	SL0	SR3	SR2	SR1	SR0
	LEFT DIAGONAL HP SIGNS				RIGHT DIAGONAL HP SIGNS			

*FIG. 39*



*FIG. 40*



*FIG. 41*

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M0=_M_PUNPCKLBW(M0, 0)	ZERO	B3	ZERO	B2	ZERO	B1	ZERO	B0
M0=_M_PSLLWI(M0, 2)	ZERO	4B3	ZERO	4B2	ZERO	4B1	ZERO	4B0
M3=_M_PUNPCKHBW(M4, M6)	SV3	V3	SV2	V2	SV1	V1	SV0	V0
M0=_M_PSUBUSW(M0, M3)	4B3-V3	4B3-V2	4B3-V1	4B3-V0				
M3=_M_PUNPCKLBW(M4, M6)	SH3	H3	SH2	H2	SH1	H1	SH0	H0
M0=_M_PSUBSW(M0, M3)	4B3-VH3	4B3-VH2	4B3-VH1	4B3-VH0				
M3=_M_PUNPCKHBW(M5, M7)	SL3	L3	SL2	L2	SL1	L1	SL0	L0
M0=_M_PSUBUSW(M0, M3)	4B3-VHL3	4B3-VHL2	4B3-VHL1	4B3-VHL0				
M3=_M_PUNPCKLBW(M5, M3)	SR3	R3	SR2	R2	SR1	R1	SR0	R0
M0=_M_PSUBUSW(M0, M3)	4B3-VHLR3	4B3-VHLR2	4B3-VHLR1	4B3-VHLR0				

FIG. 42

M7=_M_PADDB(M6, M7)	SVL3	SVL2	SVL1	SVL0	SHR3	SHR2	SHR1	SHR0
M3=_M_PSLLQI(M7, 32)	SHR3	SHR2	SHR1	SHR0	ZERO	ZERO	ZERO	ZERO
M3=_M_PADDB(M3, M7)	STOT3	STOT2	STOT1	STOT0	SHR3	SHR2	SHR1	SHR0
FFX4	0xFF	0xFF	0xFF	0xFF	0x00	0x00	0x00	0x00
M3=_M_PXOR(M3, FFX4)	STOT3	STOT2	STOT1	STOT0	SHR3	SHR2	SHR1	SHR0
	TOT HP SIGNS=1'S COMP							
ONEX	0x01	0x01	0x01	0x01	0x00	0x00	0x00	0x00
M3=_M_PADDB(M3, ONEX4)	STOT3	STOT2	STOT1	STOT0				
	TOT HP SIGNS 2'S COMP							
M3=_M_PUNPCKHBW(M3, 0)	ZERO	STOT3	ZERO	STOT2	ZERO	STOT1	ZERO	STOT0
M0=_M_PSUBSW(M0, M3)	4LPFB3	4LPFB2	4LPFB1	4LPFB0				

FIG. 43

MDX4	0x0002	0x0002	0x0002	0x0002
M0=_M_PADDW(M0, MDX4)	4LPF3+2	4LPF2+2	4LPF1+2	4LPF0+2
M0=_M_PSRLW(M0, 2)	ZERO	LPF3	ZERO	LPF2
M0=_M_PACKUSWB(M0, 0)	ZERO	ZERO	ZERO	LPF1

\*(LUM+ij)=\_M\_TO\_INT(M0) [B'3] [B'2] [B'1] [B'0]

SMOOTHED BYTES

*FIG. 44*

M6=_M_PADDB(DIRVH, DIRLR)	DVL3	DVL2	DVL1	DVL0	DHR3	DHR2	DHR1	DHR0
M7=_M_PSRLQI(M6, 32)	ZERO	ZERO	ZERO	ZERO	DVL3	DVL2	DVL1	DVL0
M7=_M_PADDB(M6, M7)	ZERO	ZERO	ZERO	ZERO	DALL3	DALL2	DALL1	DALL0

\*(DIRMAP+ij)=\_M\_TO\_INT(M7) [DALL3] [DALL2] [DALL1] [DALL0]

DIRECTION MAP

*FIG. 45*

D=1					D=2					D=3					D=4				
HIGH-PASS					HIGH-PASS					HIGH-PASS					HIGH-PASS				
0	0	-4	0	0	0	0	-4	0	0	0	0	-4	-1	-2	-2	-1	-4	-1	-2
0	0	-4	0	0	0	0	-4	0	0	0	0	-4	-4	-1	-1	-4	-4	-4	-1
0	0	16	0	0	-4	-4	32	-4	-4	-4	-4	48	-4	-4	-4	-4	64	-4	-4
0	0	-4	0	0	0	0	-4	0	0	-1	-4	-4	0	0	-1	-4	-4	-4	-1
0	0	-4	0	0	0	0	-4	0	0	-2	-1	-4	0	0	-2	-1	-4	-1	-2
LOW-PASS (87.5%)					LOW-PASS (75%)					LOW-PASS (62.5%)					LOW-PASS (50%)				
0	0	4	0	0	0	0	4	0	0	0	0	4	1	2	2	1	4	1	2
0	0	4	0	0	0	0	4	0	0	0	0	4	4	1	1	4	4	4	1
0	0	112	0	0	4	4	96	4	4	4	4	80	4	4	4	4	64	4	4
0	0	4	0	0	0	0	4	0	0	1	4	4	0	0	1	4	4	4	1
0	0	4	0	0	0	0	4	0	0	2	1	4	0	0	2	1	4	1	2
D=5					D=6					D=7					D=8				
HIGH-PASS					HIGH-PASS					HIGH-PASS					HIGH-PASS				
-2	-1	-4	-1	-2	-2	-1	-4	-1	-2	-2	-1	-4	-3	-2	-2	-3	-4	-3	-2
-1	-4	-4	-7	-3	-3	-7	-4	-7	-3	-3	-7	-7	-10	-3	-3	-10	-10	-10	-3
-4	-7	80	-7	-4	-4	-10	96	-10	-4	-4	-10	112	-10	-4	-4	-10	128	-10	-4
-3	-7	-4	-4	-1	-3	-7	-4	-7	-3	-3	-10	-7	-7	-3	-3	-10	-7	-10	-6
-2	-1	-4	-1	-2	-2	-1	-4	-1	-2	-2	-3	-4	-1	-2	-2	-3	-4	-3	-2
LOW-PASS (37.5%)					LOW-PASS (25%)					LOW-PASS (12.5%)					LOW-PASS (0%)				
2	1	4	1	2	2	1	4	1	2	2	1	4	3	2	2	3	4	3	2
1	4	4	7	3	3	7	4	7	3	3	10	16	10	4	3	10	10	10	3
4	7	48	7	4	4	10	32	10	4	3	10	7	7	3	4	10	0	10	4
3	7	4	4	1	3	7	4	7	3	2	3	4	1	2	3	10	7	10	6
2	1	4	1	2	2	1	4	1	2	2	3	4	1	2	2	3	4	3	2

*FIG.* 46